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NOTE

OUTWARD DRYING OF BASEMENT WALLS

Documentation of a laboratory experiment

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Outward drying of basement walls

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Contents

1 Introduction

In Norway, recommendations for the construction of basement walls changed in 2015. It is now recommended to use vapour-permeable thermal insulation on the exterior side of basement walls to increase outward drying. The dimpled membrane, traditionally positioned directly on the wall, between the wall and exterior insulation, is now recommended to be positioned on the outer side of the exterior insulation. Although hygrothermal simulations show that the contemporary recommendations result in dryer walls, the effects have not been sufficiently substantiated through measurements.

The main objective of the proposed laboratory experiment was to investigate the applicability of the contemporary recommendations for thermally insulated basement walls in cold climates. More specifically, we investigated the effect of the permeability of the thermal insulation and the position of the dimpled membrane on the outward drying of basement walls. The following research questions were formulated to address this objective:

1. How does the vapour permeability of exterior thermal insulation affect the drying behaviour of concrete walls?
2. How does the placement of the dimpled membrane affect the drying behaviour of concrete walls?
3. Do the results from laboratory measurements substantiate the contemporary Norwegian recommendations for basement walls?

The full details of the laboratory experiment ant its findings are planned to be presented in a scientific journal article titled " Monitoring outward drying of externally insulated basement walls - A laboratory experiment". This note summarizes the products and materials used, measured material properties, placements of the thermocouples, pictures, and specific details regarding the construction of the test setup. In addition, challenges arising during the experiment and sources of error are presented.

2 Material properties

Table 2.1: Material properties measured for the concrete and thermal insulation.

Material	**Concrete B30M60**	**Permeable EPS**	**Semi-permeable EPS**
Thermal conductivity, λ [W/(mK)][a]	1.40 [g] (measured)	0.0348 (measured)	0.0341 (measured)
Vapour permeability, δ_p [kg/(msPa)][b]	not measured	8.2 (measured)	27.9 (measured)
Density, *d* [kg/m³][c]	2418 (measured)	2272.86 (measured)	912.95 (measured)
Compressive strength 28 days after casting [MPa][d]	47.35 (measured)	not measured	not measured
Capillary absorption coefficient, A [kg/(m²s^0.5^)][e]	to be measured	not measured	not measured
Capillary moisture content, W_{cap} [kg/m³][f]	to be measured	to be measured	to be measured

[a] Heat flow metre apparatus, ISO 8391:1991.
[b] Wet cup, NS-EN ISO 12572:2016
[c] NS-EN 1602:2013, NS-EN 12390-7:201
[d] NS-EN 12390-3 (2019), NS-EN 826 (2013)
[e] Partial immersion, NS-EN ISO 1148:2002
[f] Long-term immersion, NS-EN ISO 16535:2019
[g] Measured in equilibrium with 80 % RH/23 °C.

Table 2.2: Details and properties of the concrete used in the experiment

Details regarding the ordered concrete	
Supplier	Unicon
Concrete quality	B30 M60 0.25 % red. Cl 0.10
w/c-ratio	0.54
Exposure class	X0, XC4, XF1
Type of cement	CEM II/B-M, 6-20 % FA
D_{max}	16 mm
Slump test	220 mm
Temperature	20 °C
Properties measured during the casting	
Slump test	440 mm
Temperature	9.7 °C
Density	2441 kg/m³
Air content	2.2 volume%

3 Products and materials

Table 3.1: Specific materials used in the laboratory experiment and the associated product name, producer, and placement.

Product/ material	Product name/ References*	Producer	Placements
Permeable EPS	Isodrän skiva 95 kPa [1]	ISODRÄN AS	Wall segment 1
Semi-permeable EPS	Sundolitt® EPS S150 [2]	Brødr. Sunde AS	Wall segments 2 and 3
Dimpled membrane	Platon Xtra [3]	Isola	Wall segments 1, 2, 3
Plywood boards	WISA-Form Birch [4]	WISA plywood	Wooden frame
Concrete primer	Mapeprimer M [5]	Mapei	Concrete segments
Epoxy	Mapewall I [6]	Mapei	Concrete segments
Epoxy glue	Adesilex PG1 [7]	Mapei	Wall segments
Suspended load cell	HLCB2-C3 [8]	HBM	Between the wall segments and the wooden frame
Standing-load cell	SP4M-C3 [9]	HBM	Under the wall segments
Glue	Casco SuperFix [10]	Casco	Metal fittings (glued to concrete), thermocouples, dimpled membrane
PUR Foam	Casco Foam [11]	Casco	Between metal fittings and EPS
Web camera	Conference cameras [12]	Logitech	Under the wall segments

*References:

[1] Isodrän skiva 95 kPa, ISODRÄN AS. (n.d.). https://isodren.no/produkter/isodren-platen/ (accessed May 7, 2021).
[2] Sundolitt® EPS S150, Brødr. Sunde AS. (2018). https://www.sundolitt.com/no/sundolitt/norway/vegg/isolasjon-og-knotteplast/eps-s150-14d1cee9/ (accessed June 1, 2021).
[3] Platon Xtra, Isola. (n.d.). https://www.isola.no/produkter/grunn/grunnmursplate/platon-xtra?gclid=CjwKCAjwhMmEBhBwEiwAXwFoEd9QXwC1U__eKc8oRnuZzV0Jxf5h9FrW9wjqDbjGg6eYGqhRLhRrOBoCZ68QAvD_BwE (accessed May 7, 2021).
[4] WISA-Form Birch, WISA PLYWOOD. (n.d.). https://www.wisaplywood.com/products/product-catalogue/wisa-form-birch/ (accessed May 7, 2021).
[5] MAPEPRIMER M, Mapei. (n.d.). https://www.mapei.com/no/no/produkter-og-systemlosninger/produktliste/produktdetaljer/mapeprimer-m (accessed May 7, 2021).
[6] MAPEWALL I, Mapei. (n.d.). https://www.mapei.com/no/no/produkter-og-systemlosninger/produktliste/produktdetaljer/mapewall-i (accessed May 7, 2021).
[7] ADESILEX PG1, Mapei. (n.d.). https://www.mapei.com/no/no/produkter-og-systemlosninger/produktliste/produktdetaljer/adesilex-pg1 (accessed May 7, 2021).
[8] HLC load cells, HBM. (n.d.). https://www.hbm.com/en/2707/hlc-beam-load-cell-with-6-wire-technology/ (accessed May 7, 2021).
[9] SP4M load cells, HBM. (n.d.). https://www.hbm.com/en/3010/pw15b-robust-stainless-steel-single-point-load-cell/ (accessed May 7, 2021).
[10] Casco SuperFix, Casco. (n.d.). https://www.casco.eu/no/casco-produkter-1/?pc=678&p=905 (accessed May 7, 2021).
[11] Casco Foam, Casco. (n.d.). https://www.casco.eu/no/casco-produkter-1/?pc=133&p=5650 (accessed May 7, 2021).
[12] Logitechs conference cameras, Logitch. (n.d.). https://www.logitech.com/no-no/video-collaboration/products (accessed May 16, 2021).

4 Thermocouple placements

The front view of the wall segments is shown on the exterior side. The name tags were allocated to the thermocouples as follows: H (high), M (middle), L (low), S (side), e (exterior), m (middle), i (interior), and md (at the dimpled membrane). Numbers 1, 2, and 3 refer to the wall segment number.

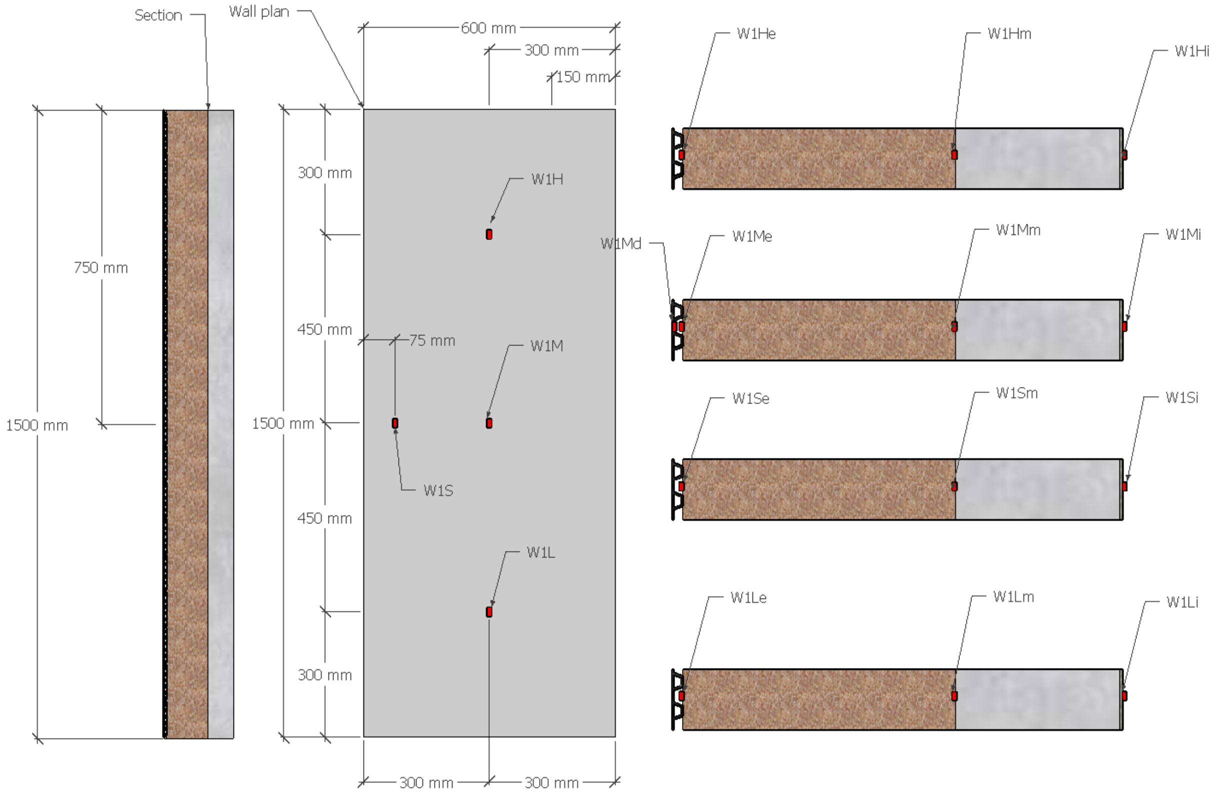


Figure 4.1: Diagram of thermocouple placement in the permeable wall indicated in red. The sketch in the middle shows the front view of the wall segment from the exterior side. The sketches at the right and left show the cross-section of the wall segment.

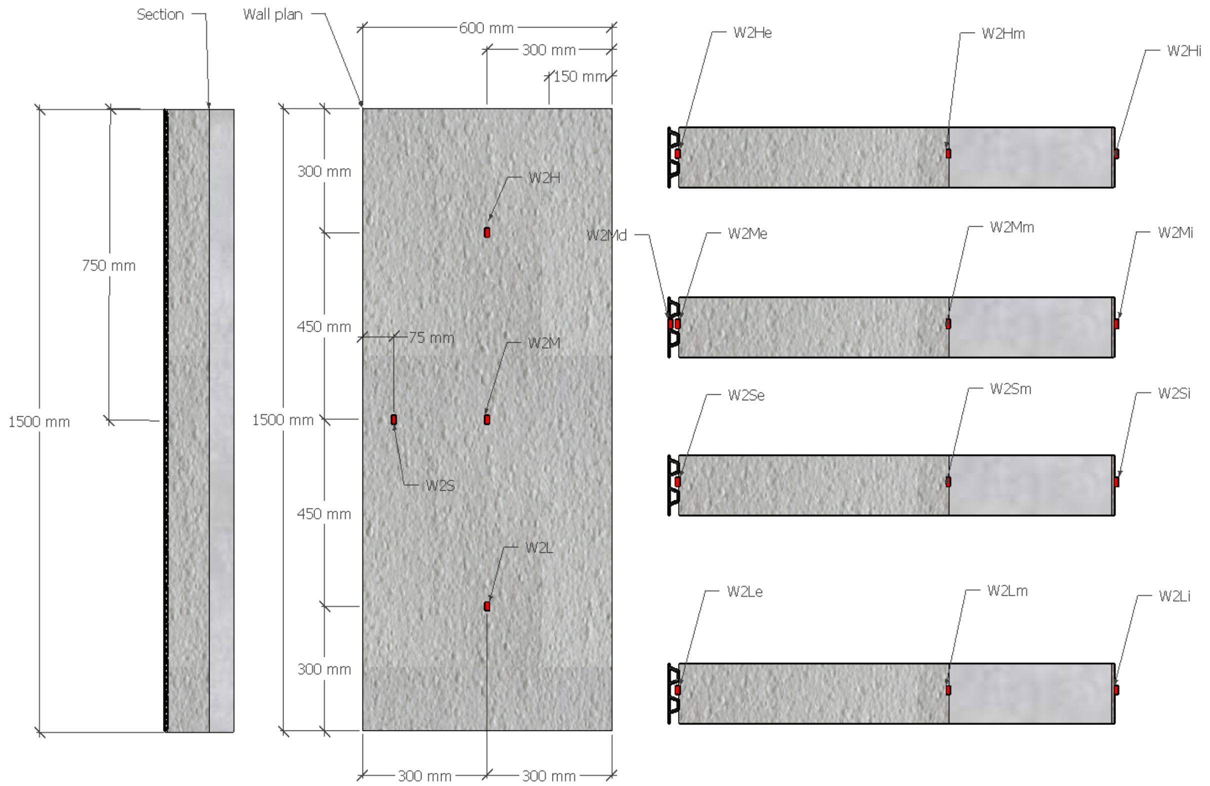


Figure 4.2: Diagram of thermocouple placement in the semi-permeable wall indicated in red. The sketch in the middle shows the front view of the wall segment from the exterior side. The sketches at the right and left show the cross-section of the wall segment.

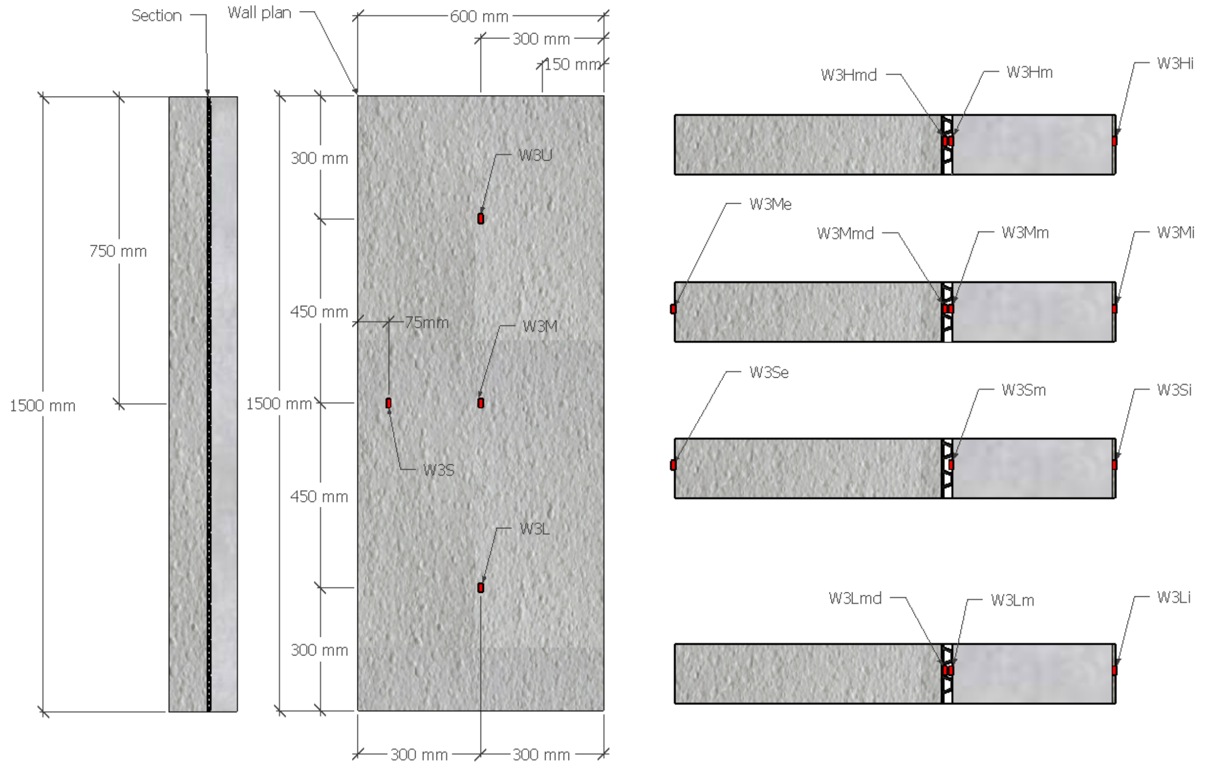


Figure 4.3: Diagram of thermocouple placement in the traditional wall indicated in red. The sketch in the middle shows the front view of the wall segment from the exterior side. The sketches at the right and left show the cross-section of the wall segment.

5 Details and pictures

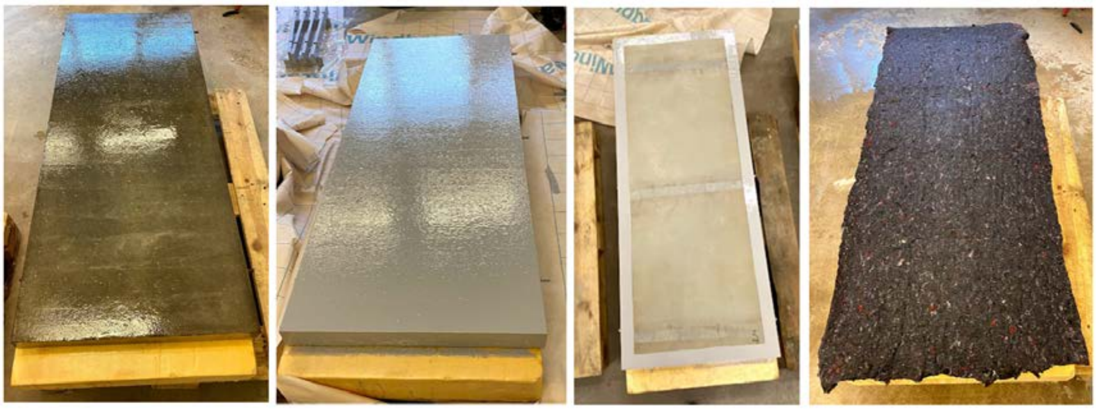
5.1 Casting of the concrete segments

The formworks of the concrete segments were constructed using water-resistant plywood boards with internal measurements corresponding to the dimensions of the concrete segments (60 × 600 × 1500 mm). Three Ø10 reinforcement bars were placed through drilled holes on the long side of the formwork (centred in the middle of the cross-section). The remaining bars were attached using steel wires. Horizontal and vertical reinforcement bars were placed with centre distances of approximately 100 mm and 83 mm, respectively, and a surface cover of 50 mm, as shown in Figure 5.1. The concrete was produced by Unicon and transported from the concrete plant to the laboratory premises by a concrete mixer truck. The concrete segments were horizontally cast in the formwork. A vibrating poker was gently used during casting to release the air pockets and level the surface. The concrete surface was brushed a few hours after casting to ensure that the drying surface was even. The concrete segments were covered with wet towels and sealed in plastic during the first three days, after which they were placed in a water bath for 25 days (28 days of curing in total). The formwork was removed one day after casting. Two Vemo sleeves per concrete segment were embedded into the top of the concrete during casting, centred in the middle of the cross-section 300 mm apart. The Vemo sleeves constituted the attachments for the suspension of the concrete segments. Bolts were temporarily screwed into the Vemo sleeves to prevent corrosion of the sleeves.

Figure 5.1: Formwork, reinforcement, and Vemo sleeves (left), a concrete segment straight after removing the formwork with the drying surface facing upwards (right).

5.2 Surface treatment of the concrete segments

Once the concrete segments had been extracted from water, they were placed on extruded polystyrene (XPS) boards with the drying surface (upper side of the cast) facing down to prevent evaporation. Primer was applied to all sides except the drying surface once the surfaces had become visibly dry (a few hours after extraction from water). After 51 h, the corresponding sides were coated twice with epoxy applied at 20 h time intervals (see Figure 5.2). The concrete segments were then turned around, and the drying surface was treated as follows: the entire drying surface was gently ground by hand with a grindstone and brushed to remove dirt from the water bath. Two coats of epoxy were applied along the side edges of the drying surface with a width of 50 mm, at 7 h time intervals (Figure 5.2). In this way, the drying area of the concrete surface was 500 × 1400 mm, and the impact of unfavourable edge effects was limited. When the epoxy paint had been dried for 13 h, the drying surface was wetted and covered in soaked shoddy and a vapour barrier overnight (see Figure 5.2). The shoddy was removed, and a vapour barrier was taped to the drying surface during mounting in the wooden frame to maintain a high moisture content before the onset of the measurements (see Figure 5.4).



a b c d

Figure 5.2: Interior side of a wall segment treated with primer (a) and epoxy paint (b). Drying area of the exterior surface (c) and the wet shoddy (d).

5.3 Preparation of thermal insulation and dimpled membranes

The thermal insulation and dimpled membrane were stored in the laboratory premises and exposed to climatic conditions of approximately 20 °C and 20 % RH. This period amounted to three days for the permeable thermal insulation and approximately two weeks for the dimpled membrane and semi-permeable thermal insulation. The thermal insulation was cut using a band saw, and the dimpled membrane was cut using scissors. As the permeable thermal insulation is produced with dimensions of 750 × 1000 mm, two boards were joined with two adjacent cut surfaces 900 mm above the bottom of the wall segment. The height of the dimpled membrane was 1000 mm, and two dimpled membranes were glued together with two overlapping knobs, 1000 mm above the bottom of the wall segments. The two types of thermal insulation and the dimpled membrane are depicted in Figure 5.3.

Figure 5.3: Dimpled membrane (left), permeable insulation (middle), and semi-permeable insulation (right).

5.4 Construction of the wooden frame

The wooden frame was constructed as shown in Figure D4, with dimensions of 3830 × 3800 × 206 mm. Construction timber with dimensions of 48 × 198 mm was used for the studs and support beam in the wooden frame. Double studs and beams were glued and screwed together to avoid creep deformation during weighing of the weighed wall segments. Heat transfer between the exterior and interior climatic chambers was prevented by insulating the wooden frame with 200 mm mineral wool. The air conditioning system in the exterior and interior climatic chambers was equipped with fans to create powerful air flows to ensure a well-mixed atmosphere. Therefore, a vapour-barrier covering the entire interior side of the wooden frame was sealed to the edges of the frame using vapour-barrier tape to avoid air penetration or air washing of the wall segments and grease-filled gap. Plywood sheets were mounted on the exterior and interior sides of the wooden frame to ensure lateral bracing, leaving recesses for mounting, instrumentation, and inspection of the weighed wall segments. In the recesses, the joints between the vapour barrier and construction timer were sealed with vapour barrier tape. The initial test series of climatic exposure in the exterior climatic chamber revealed condensation and water dripping from the roof. Therefore, a roof overhang was mounted on the wooden frame, providing cover and rainproofing of the weighed wall segments, as depicted in Figure 5.4. Finally, the joints in the plywood sheets were sealed with a wind barrier tape on the exterior side of the wooden frame.

Figure 5.4: Wooden frame (left) and roof overhang (right)

5.5 Mounting of the wall segments and thermocouples

Each wall segment was instrumented with 13 thermocouples to measure temperatures. The wall segments and thermocouples were mounted successively in the following order. First, the concrete segments were hung in the load cells in the wooden frame and thermocouples were attached. Prior to mounting the thermal insulation and dimpled membrane onto the wall segments, the materials were assembled on the floor, and the thermocouples were glued onto the assigned material surfaces, as shown in Figure 5.5.

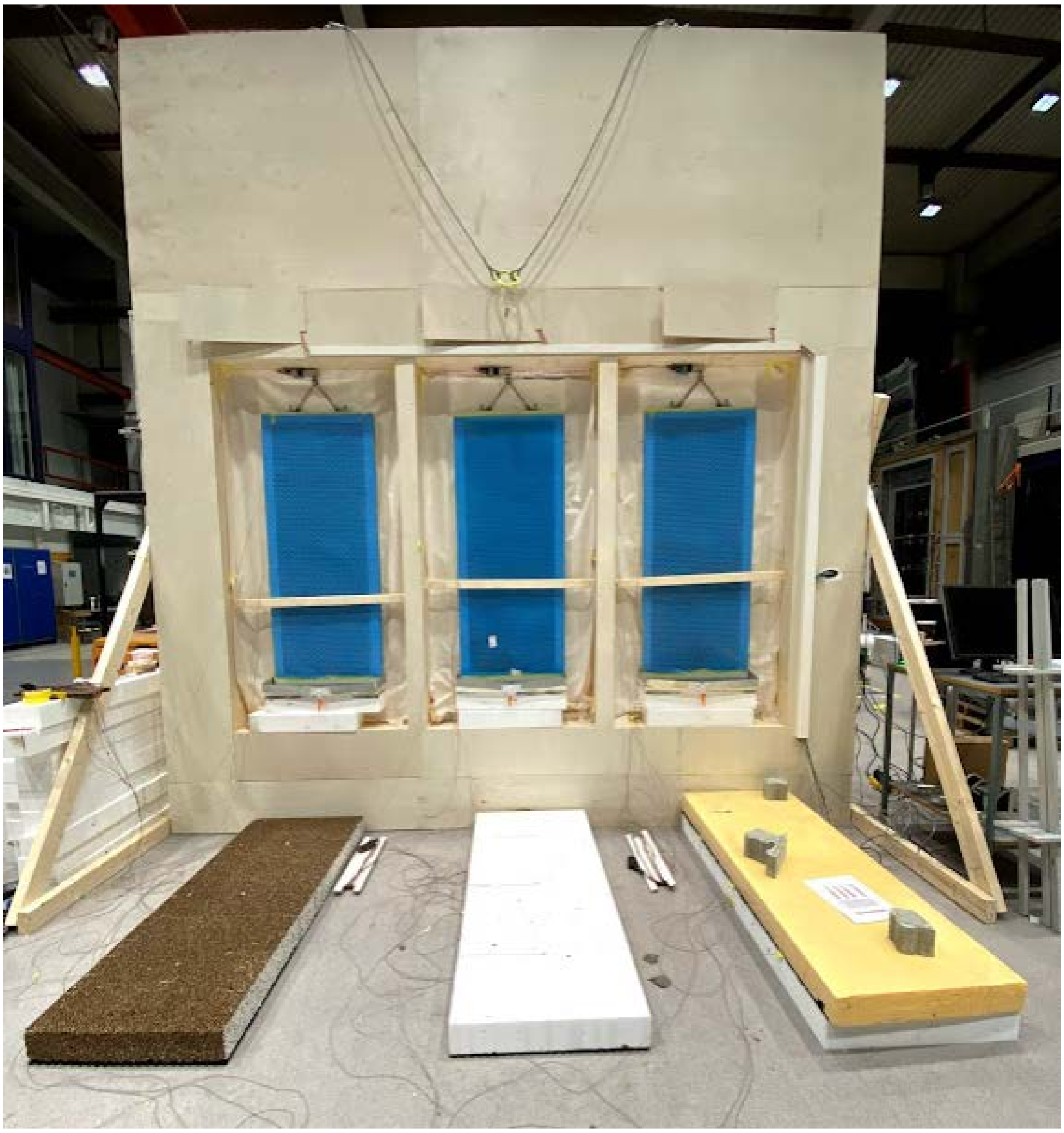


Figure 5.5: Concrete segments mounted in the wooden frame. The thermal insulation and dimpled membrane were assembled on the floor, and the thermocouples were attached before mounting them on the concrete segments.

To avoid screws penetrating the wall segments, the thermal insulation and dimpled membranes were gently pressed against the concrete segments and held in place by means of frames and band-hose clamps, as shown in Figure 5.6. The frames were composed of water-resistant plywood boards, brushed with sandpaper, and sealed with two coats of epoxy to limit moisture uptake in the wood fibres. The vapour barrier in the wall recesses was temporarily covered with a wind barrier on the exterior side during assembly to reduce the risk of puncturing the vapour barrier. The drying surface of the concrete segments was temporarily covered with a vapour barrier to reduce surface evaporation during the wall assembly.

Figure 5.6: Thermal insulation and dimpled membrane gently pressed against the concrete segments and held in place by means of frames and band-hose clamps.

5.6 Edge insulation, frame insulation, and grease-filled gap

The grease-filled gap was 5–10 mm wide along the sides of the weighed wall segments and 10 mm wide above and below the weighed wall segments (see Figure 5.7). The edge insulation had a thickness (depth) of 167.5 mm (corresponding to the total depth of the wall segments), and the frame insulation had a thickness (depth) of 200 mm (corresponding to the total depth of the wooden frame). The edge insulation, grease-filled gap, and frame insulation were prepared and assembled as follows: the edge insulation was glued to the wall segments, and grease was applied along the sides of the edge insulation facing the grease-filled gap. Then, the frame insulation was positioned alongside the studs in the wooden frame, and grease was applied to the gap from the exterior side. The edge insulation above the wall segments was hand-cut to fit the attachment details around the suspended load cells and was positioned above the plastic flashings (not glued), as depicted in Figure 5.7.

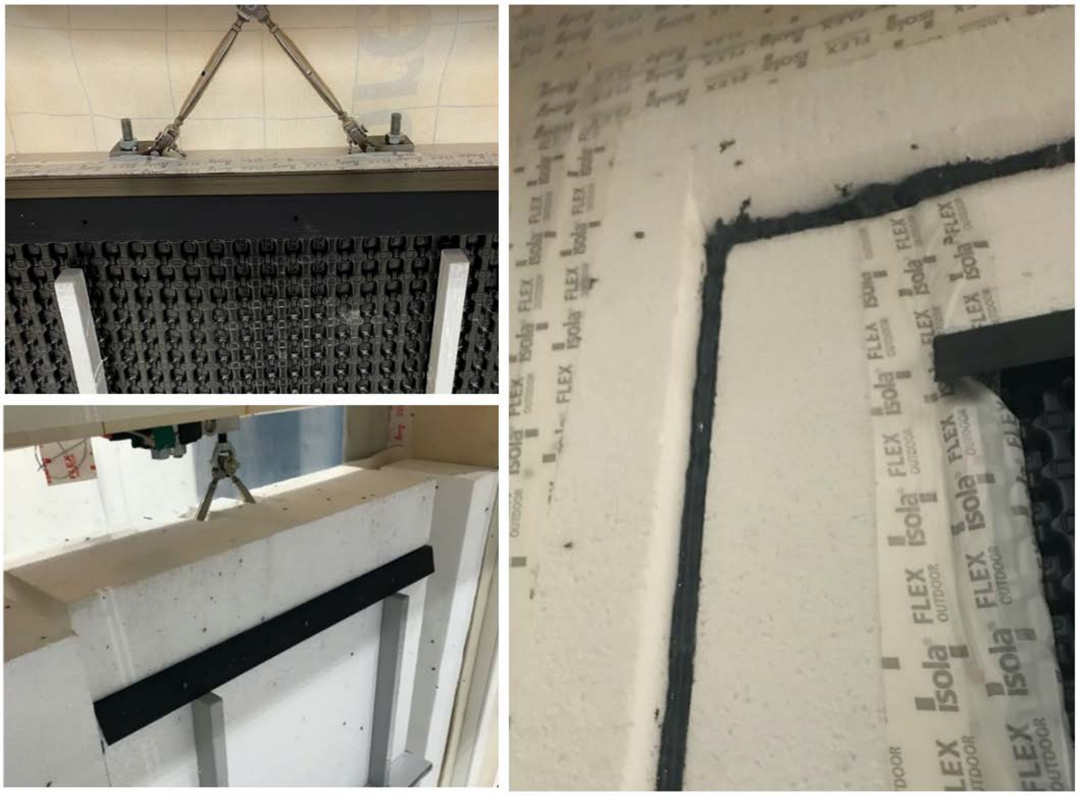


Figure 5.7: Plastic flashing taped to the concrete segment using vapour-barrier tape (upper left), edge insulation during assembly (lower left), and grease-filled gap (right).

5.7 Mounting and adjustment of load cells

To hang the weighed wall segments in the suspended load cells, bolts were screwed into the Vemo sleeves embedded into the concrete during casting. Steel plates, steel angles, and nuts were attached to the bolts. The steel angles were tailor-made with oblong slots horizontally to allow for adjustments of the centre of gravity of the weighed wall segments. Jaw-to-jaw rigging screws were used between the steel angles and the suspended load cells to allow for sideways adjustments of the wall segments. The suspended load cells were mounted by means of dowels inserted through oblong slots in the support beam, permitting adjustments of the load cells so that the weighed wall segments could hang flush with the vapour barrier on the interior side of the wooden frame. Small steel plates were mounted above and below the attachment of the load cells in the support beam to distribute the pressure on the timber. The suspended load cell and attachment details are shown in Figure 5.8.

Figure 5.8: Suspended load cell and attachment details (left), and steel plate mounted above and below the attachment of the load cells (right).

Standing-load cells were mounted beneath each wall segment at the exterior side of the wooden frame as follows: the load cells were screwed onto brackets made of plywood, and thin steel plates constituting the foundations for the water tanks were mounted on top of the cells (see Figure 5.9). As the load cells worked as cantilever beams, small steel spacers were mounted between the standing-load cells and steel foundations for the water tanks.

Figure 5.9: The load cells weighing the condensed water were screwed onto brackets made of plywood.

5.8 Accuracy of load cells

The load cells were calibrated with fixed weights before the experiment started. A load cell factor from the factory was used to calculate the load, which corresponded to the calibration. A Butterworth filter with a cut-off frequency of 0.05 Hz was used to eliminate noise from the input signal and remove additional background noise. Sampling points were measured every second, and mean values were logged for every 20th sampling point (every 20th second).
The accuracy of the load cells can be affected by temperature, creep, and drift with regard to long-term stability. The impact of temperature depends on the size of the applied load. With a

light load, as for the weighing of condensed water, the impact is very small. With a heavy load, as for the weighing of the wall segments, the impact is high. The response to the impact is not linear; it takes longer to return to the original load even if the temperature does so relatively quickly. To take in to account the impact of temperature, the temperature variation at each suspended load cell were measured using PT100 thermistors. Accurate compensation of temperature impact can be time consuming to get calibrated. A linear mean ratio as in the equation in the program (DeltaT * 0.0353) was tested, which in practice means accounting for a linear correlation of 35 g/°C between the load and temperature. This approach did, however, not account for the impact of temperature in a satisfactory way. The measured weight changes are therefore illustrated along with the temperatures measured on the load cells in Figure 8.

The impact of creep and drift was compensated for by the automatic calibration of the system every 5 min. The potential influence of creep would be equal for each wall segment and thus it does not affect the comparison of the wall segments' performance. If creep/drift occurred, a higher weight loss than occurring would have been measured, that is, the measured weight loss would be higher than the occurring.

5.9 Collection of condensed water

To transfer condensed water from the wall segments to the water tanks, metal fittings with plastic funnels and plastic tubes were mounted underneath the wall segments (see Figure 5.10). The funnels were hand-cut and glued to the metal fittings using butyl tape. The metal fittings were degreased, and a hydrophobic coating was applied to the upper surface to ease the runoff of water. To seal the airgaps underneath the metal fittings, polyurethane foam was applied to the bottom side and glued to the EPS. Eventually, the metal fittings were glued to the bottom of the concrete. The water tanks were glued to the steel plates at the standing-load cells. Then, the water tanks were filled with sunflower oil, and the metal fittings and water tanks were covered with vapour-barrier tape to reduce the evaporation of moisture. A small gap between the tape and wall segments allowed for some air exchange to the exterior air.

Figure 5.10: Metal fittings and water tanks mounted underneath the wall segments.

5.10 Web cameras

Web cameras were installed to film and take images of possible runoff underneath each wall segment. Each camera was mounted on the wooden frame and filmed through a drilled hole in the corner of the metal fitting (see Figure 5.11). LED lights were turned on when the cameras were filming or taking photographs.

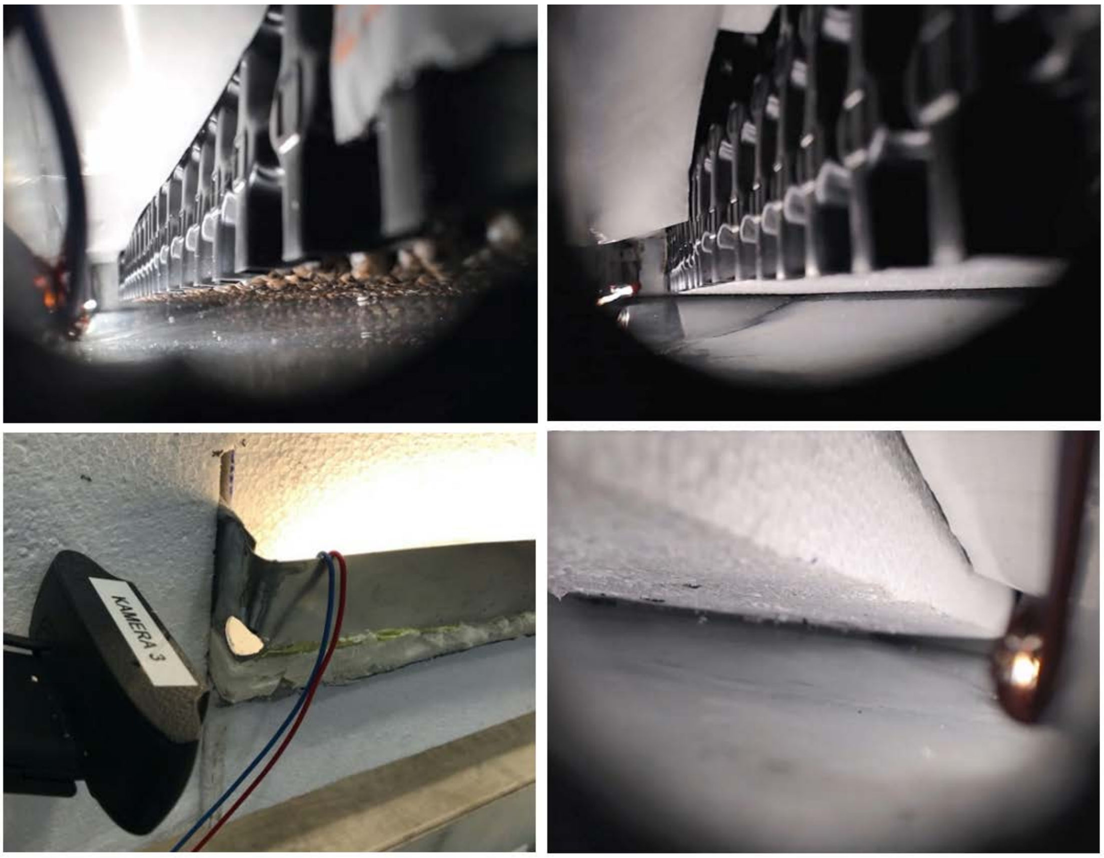


Figure 5.11: Web cameras were installed to film and take photographs of possible runoff underneath each wall segment.

6 Uncertainties and challenges

6.1 Challenges arising during the experiment, solutions, and implications

Table 6.1: Challenges arising during the experiment, solutions, and implications

Nr.	Challenge	Solution	Implications
1	The drying surface of the concrete segment was not pressed hard enough onto the XPS boards in the corners when the primer/paint was applied - some moisture might have evaporated.	The drying surfaces of the three concrete segments were flushed with water, covered with soaked shoddy, and wrapped in a vapour barrier overnight.	The moisture content in the concrete is assumed to be re-established.
2	When primer was applied to the interior surface and sides of the concrete segments, some primer ran down and formed droplets at the edge of the drying surface.	The solidified drops of primer were removed, and a 5 cm wide flange was painted around the sides of the drying surface to eliminate the differences between the walls.	The flange helped limit the influence from the edges of the wall segments on the drying (the cup method is performed in a similar manner). A smaller drying area implies lesser/slower drying and lesser weight loss to document.
3	The dimpled membrane sunk approximately 1 cm during the assembly.	The tape over the fitting was temporarily removed. A wallpaper knife and scalpel with an adapted shaft were used to cut away the excessive part.	The air gap was open for convection and condensed water would be able to run down to the fitting below.
4	The transition between the fittings and downpipes had a significantly uneven protruding welded edge.	The downpipe was cut off and the welded edge was bent down using pliers. Funnels and hoses were used to enable water to run down into the water tanks.	Positive: Water would flow more easily into the water tank, without being left in the fittings and would evaporate to the cold room.
5	The intended location of the cameras failed to film the underside of the wall (as it did during testing).	The hole in the fittings was widened at the bottom, and the camera was placed further down.	It was possible to take photographs/videos of the runoff.
6	Water may evaporate from the fittings before running into the water tank.	The fitting was applied with hydrophobic coating and a vapour-barrier tape was glued over the opening above the fittings to reduce air flow.	The risk of the moisture evaporating before measurement was reduced. Some evaporation is expected.
7	Water may evaporate from the precipitation measurement devices before being measured.	Load cells for weighing water runoff in buckets were selected instead of precipitation measuring devices.	The risk that moisture would evaporate before measurement was reduced. Some evaporation must be taken into account.
8	The increased heat transfer around the edges of the concrete sample may influence the moisture transfer.	The edges around the wall segments were insulated to reduce this effect.	The impact of the edge is reduced.

10	Friction and air leakages in the air gap between the wall segments and the wooden frame may affect the weighing.	The initial solution to seal the gap using a filling strip and mineral wool was replaced with a solution using grease.	Positive: The friction and air leakages are reduced.
11	Fastening of the dimpled membranes and insulation with screws would pose a risk of air leaks, differences between the walls, and might affect the hygrothermal performance.	Wooden frames, made of water-resistant plywood boards, were used to hold the materials in place.	The negative impact from screws/fastenings was avoided.
12	The plywood frames used to fasten the dimpled membrane and insulation might take up moisture from the moist air in the exterior chamber.	The plywood frames were sanded and painted with epoxy.	The risk of moisture uptake in the frames was reduced.
13	The reinforcement could not be placed on support blocks because then holes would form in the concrete cast on the hot side, which would affect the drying.	The reinforcement was screwed through the sides of the formwork and cut after curing.	Holes in the concrete samples were avoided.
14	Condensed water dripped from the ceiling into the climate simulator.	A roof overhang was made to protect the walls.	The walls were protected against dripping water, which might affect the weight measurements.
16	The walls needed to have the possibility of adjustments to hang straight in the wooden frame.	Attachments were specially developed to be able to adjust the walls both sideways and in depth and to move the walls close to the vapour barrier on the interior side.	The walls could be levelled in all directions and positioned in line with the vapour barrier.
17	The concrete segments were casted horizontally. This is the most practical approach as they are relatively thin. It was important to avoid segregation and the surface needed to be smooth to ensure close contact with the thermal insulation.	The upper side of the cast concrete segments was used as the drying surface (although the lower side of the cast is flatter/smoother because it faced the formwork). The casting was performed by professionals. A vibrator was used carefully to avoid segregation. The concrete was ordered from Norcem and not mixed on site.	Vibration can extract the air of the concrete and can provide a smooth surface with an equal distribution of fines. The foundation plate can lie flat against the drying surface. Fine matter settles in the drying surface and contributes to better drying. Norcem delivers all the concrete in one batch to ensure equal concrete samples.
18	The initial moisture content in the walls should be known.	The walls were cured in a water bath.	Ensured equal curing conditions and known initial moisture content (as opposed to curing wrapped in plastic).
19	The walls should not be able to dry out during the	The walls were cured in a water bath, placed on XPS	The concrete segments were moist at the start of the

	mounting before the measurements had started.	(with the drying surface down) when primer and paint were applied, flushed with water, covered with wet shoddy (to restore the moisture content), and covered with a vapour barrier when mounted in the wooden frame. Materials/sensors were assembled fully on the floor and mounted directly when the vapour barrier on the drying surface was removed.	measurements. Some uncertainties were acknowledged, but the three walls were given the same treatment and should therefore be comparable.

6.2 Source of error and uncertainties in results

Table 6.2. Source of error and uncertainties in results

Nr.	Source of error	Implications
1	The amount of moisture diffusing thorough the five coated sides of the concrete segments is unknown.	The s_d-value of the epoxy paint (two coatings, no primer) is, according to the producer, 41 m. Although the permeability is not confirmed by measurements, the three walls were treated with the same amount of paint.
2	More reinforcement was used than initially planned.	The wall samples are similar to real basement walls, but contain lesser moisture and dry more slowly as the area for drying is reduced.
3	The reinforcement bars on the sides of the concrete segments protruded 0.2–1 cm after cutting. Thus, it became challenging to fit the edge insulation.	More adhesive had to be applied. The gap between the edge insulation and frame insulation became slant (wider at the outside than at the inside). Thus, it was difficult to fit the frame insulation. The grease-filled gaps became larger than intended (5–10 mm instead of 2–3 mm).
4	Some cracking occurred in the adhesive used to seal the sides of the wall segments (between the wall segments and the edge insulation).	The wall segments seemed to be sufficiently sealed. Some convection might occur in the cracks and cool the sides of the thermal insulation in the wall segments. To prevent convection, the transitions were taped with wind barrier tape on the exterior surface. The effect of the small cracks on the drying is uncertain.
6	It is uncertain if the wind barrier tape used on the cracks maintain adhesion to the EPS over time.	The wind barrier tape seems to have worked as intended during the period of 6 months.
7	Ordinary wooden beams were used in the wooden frame instead of laminated timber, which is more dimensionally stable.	Biases in the wooden frame led to problems regarding tightness in the transitions between the wooden frame and the climate simulator. It is more difficult to maintain a stable climate without adequate sealing. Tape was used on the sides and roof to reduce air leaks into the cold and hot chambers. The walls are nevertheless exposed to the same climate.
8	The angle on the fittings under the walls could have been steeper.	Droplets on the fittings may evaporate before reaching the water tanks. However, the cameras revealed that no condensed water ran down from the wall segments.
9	Two EPS boards with grease in between were used to test the workability of the grease. After the experiment was initiated, discoloration was observed on the EPS boards.	This observation suggests that oils in the grease may have diffused into the EPS over time. Although this may have some impact on the weights of the walls, the walls are subjected to the same amount of grease, and are thus equally affected. In contrast, XPS is stiffer and easier to cut and can reduce the risk of diffusion. Thus, XPS is a better choice for the edge/frame insulation.
10	Air circulation in the cold chamber may create air flow into the metal fittings and contribute toward an increase in the drying.	To reduce the air flow, the openings over the metal fittings were partially covered with tape. The taping was performed equally on the three walls, with a small airgap close to the wall segments.

11	It is not possible to separate the weight of the insulation and concrete. The moisture content in the wall's insulation was not initially measured. Moisture from the concrete diffuses into the insulation before drying to the exterior and causes weight changes.	The moisture content in the thermal insulation boards should have been measured when the experiment started. Because the initial moisture content is unknown, uncertainties are associated with the drying behaviour of the walls at the beginning of the measuring period.
12	The impact of creep/drift was not measured and accounted for at the end of the measurement period as intended.	The potential influence of creep/drift would be equal for each wall segment and thus it does not affect the comparison of the wall segments' performance. If creep/drift occurred, a higher weight loss than occurring would have been measured, that is, the measured weight loss would be higher than the occurring.

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